

Attenuation Grade **TiO₂ Dispersions**

Titanium Dioxide (TiO₂) is a well known pigment, because of its high refractive index. It also functions as an effective UV absorber when the primary particle size is under 100 nm. Titanium Dioxide is ideal for formulating mild or hypoallergenic sun care products for UVA/UVB protection for babies and children, and consumers with sensitive skin. It's the physical and chemical stability of titanium dioxide, which differentiates this filter from organic UV absorbers.

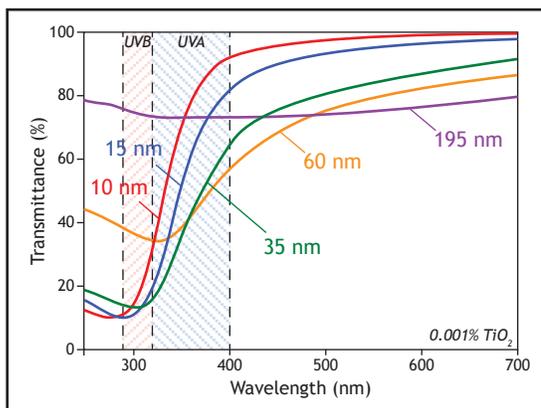
Titanium Dioxide is available in a wide range of primary particle sizes and varying optical properties. However, Titanium Dioxide is not supplied as individual crystals, but as aggregates of primary particles. The degree of aggregation

is a function of the primary particle size and manufacturing process. These large aggregates may reduce the protection of the formula against UV light, and likewise scatter visible light, sometimes creating an ashy look when sun care products are applied on skin.

Kobo specializes in the custom formulation and dispersion of TiO₂. We offer a wide selection of Titanium Dioxide dispersions that include various particle sizes, surface treatments, and a wide range of carriers, including volatile solvent bases. Kobo can also provide formulation assistance based on our extensive experience formulating and testing sunscreen products containing inorganic UV filters.



There is a wide range of TiO₂ available with different primary particle sizes (PPS). These pictures compare the transparency of TiO₂ dispersions (at 20% concentration) of various PPS on two different skin types. The small primary particle size Titanium Dioxide dispersion shows high transparency and is also likely to be efficient against UVB light.



This figure shows transmittance curves. The curves show the relationship not only between particle size and transparency, but also between particle size and UVA/UVB balance. As the particle size becomes very small, UVB attenuation is strong but UVA attenuation is weak. The Titanium Dioxide particle size must be in a medium range if balanced protection in both the UVA and UVB regions is desired.

Sunscreen Stick with HBTN65HP1 & HBTN55TIS

SPF 31.40
UVA-PF 10.87

Formula KSL-171A

Part 1

- Unitolate 160K - Universal Preserv-A-Chem: Caprylic/Capric Triglyceride 29.84%
- **HBTN55TIS** - Kobo Products: Butyloctyl Salicylate (And) Titanium Dioxide (And) Isostearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate 13.64%
- Ozokerite Wax White SP 1020P - Strahl & Pitsch: Ozokerite 11.00%
- Jeechem ISIS - Jeen International: Isostearyl Isostearate 9.00%
- **HBTN65HP1** - Kobo Products: Zinc Oxide (And) Butyloctyl Salicylate (And) C12-15 Alkyl Benzoate (And) Triethoxycaprylsilane 7.22%
- Lanolin Technical Grade - RITA Corp: Lanolin 6.00%
- Candelilla Wax - Frank B. Ross: Euphorbia Cerifera (Candelilla) Wax 5.50%
- Castor Oil - Alzo International: Ricinus Communis (Castor) Seed Oil 5.00%
- Carnauba Wax - Strahl & Pitsch: Copernicia Cerifera (Carnauba) Wax 4.50%
- Softisan® 100 - Condea Chemie: Hydrogenated Coco-Glycerides 4.00%

- Beeswax White SP 422P - Strahl & Pitsch: Beeswax 4.00%
- Vitamin E Acetate - BASF: Tocopherol Acetate 0.30%

Manufacturing Procedure

Add all ingredients together and heat to 70-80°C. Mix until all waxes are melted and pour into sticks at 78-80°C.

Description

This stick applies smoothly and is convenient to use. This sunscreen uses Kobo's Zinc Oxide Dispersion, HBTN65HP1 and Titanium Dioxide Dispersion, HBTN55TIS, for UVA/UVB protection. The Butyloctyl Salicylate is a booster to help increase the SPF value. This formula contains 8.23% Butyloctyl Salicylate

Active Ingredients:

- Zinc Oxide = 4.60%
- Titanium Dioxide = 6.00%

SPF testing: in vivo on 3 subjects

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TiO₂ Dispersions

Carrier/ Solvent	Product Name	INCI Name	Primary Part. Size	Particle Size**	Active %	Viscosity
Silicones	CM3K25VM-AL*	Cyclopentasiloxane (And) Titanium Dioxide (And) Alumina (And) PEG-10 Dimethicone (And) Hydrogen Dimethicone	10 nm	120 nm	20	pourable
	CM3K40T4*	Cyclopentasiloxane (And) Titanium Dioxide (And) PEG-10 Dimethicone (And) Alumina (And) Hydrogen Dimethicone	15 nm	120 nm	33	pourable
Mixed Solvents	KFS40VM-AL*	Caprylyl Methicone (And) Titanium Dioxide (And) Cyclopentasiloxane (And) C12-15 Alkyl Benzoate (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone (And) PEG-9 Polydimethylsiloxyethyl Dimethicone	10 nm	125 nm	31	pourable
	KFS40VBAS-C	Titanium Dioxide; Caprylyl Methicone; Cyclopentasiloxane; C12-15 Alkyl Benzoate; Alumina; Polyhydroxystearic Acid; Triethoxysilylethyl Polydimethylsiloxyethyl Hexyl Dimethicone; Lauryl PEG-9 Polydimethylsiloxyethyl Dimethicone	10 nm	130 nm	31	pourable
	KFS40M170*	Caprylyl Methicone (And) Titanium Dioxide (And) Cyclopentasiloxane (And) C12-15 Alkyl Benzoate (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone (And) PEG-9 Polydimethylsiloxyethyl Dimethicone	14 nm	150 nm	32	pourable
	HBTN55TIS	Butyloctyl Salicylate (And) Titanium Dioxide (And) Isostearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate	15 nm	110-150 nm	44	paste
Esters/Oils	TNP40VTTS	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Isopropyl Titanium Triisostearate (And) Triethoxycaprylylsilane	10 nm	100 nm	32	pourable
	TNP40VM-AL*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone	10 nm	105 nm	32	pourable
	GCP50VTTS	Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Isopropyl Titanium Triisostearate (And) Triethoxycaprylylsilane	10 nm	110 nm	40	pourable
	TNP50T7-ATB*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Argania Spinosa Kernel Oil (And) Alumina (And) Hydrogen Dimethicone (And) Tocopheryl Acetate (And) Polyhydroxystearic Acid (And) Bisabolol	15 nm	118 nm	38	pourable
	TNP50T7*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone	15 nm	120 nm	40	pourable
	INP60T7*	Titanium Dioxide (And) Isononyl Isononanoate (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid	15 nm	126 nm	48	pourable
	IN60S4*	Titanium Dioxide (And) Isononyl Isononanoate (And) Stearic Acid (And) Aluminum Hydroxide	15 nm	130 nm	49	paste
	TN40S4*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide	15 nm	140 nm	33	paste
	TNQP55T5S*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid	30 nm	168 nm	45	paste
TNQP50TEL6*	C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Silica (And) Polyhydroxystearic Acid	50 nm	190 nm	44	pourable	
Natural Esters/Oils	JOSP40TIS	Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Isostearic Acid (And) Polyhydroxystearic Acid	15 nm	130 nm	33	pourable
	GCO45TV*	Titanium Dioxide (And) Caprylic/Capric Triglyceride (And) Sorbitan Olivatate (And) Stearic Acid (And) Aluminum Hydroxide	15 nm	131 nm	37	paste
	GC40S4*	Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Stearic Acid	15 nm	140 nm	33	paste
	JO40S4*	Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Stearic Acid	15 nm	145 nm	32	paste
	GCP55TJ*	Titanium Dioxide (And) Caprylic/Capric Triglyceride (And) Jojoba Esters (And) Polyhydroxystearic Acid	35 nm	139 nm	52	paste
	GCQP55T5S*	Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid	35 nm	161 nm	45	pourable
Aqueous <small>New</small>	WBG40TWP*	Water (And) Titanium Dioxide (And) Butylene Glycol (And) Hydrated Silica (And) Ammonium Polyacrylate	15 nm	188 nm	28	pourable

*These TiO₂ products comply with the conditions for Titanium Dioxide (nano) as set forth in the Annex VI to Regulation (EC) No 1223/2009.

**Size in dispersion: intensity-weighted mean size measured on Dynamic Light Scattering particles sizer

This table was prepared to assist in formulating with Titanium Dioxide Dispersions. The information contained herein is believed to be accurate at the time of printing and represent typical values, but should not be used as a substitute for product specification sheets.

Kobo also offers Dispersions in Volatile Non-D5 Carriers. Please see separate flyer.

Our dispersions are often divided into two general categories:

1. **High Solids® Dispersions:** These are usually in paste form and have a high active TiO₂ loading and efficacy (up to 5 SPF units/ TiO₂%), which is necessary for formulating for very high SPF.
2. **High Speed™ Dispersions:** These are usually pourable and easy to incorporate into a formulation. They are highly transparent.

Formulation guidelines

estimation of use level for SPF

10 -15 nm TiO₂ Dispersions

1. PPS < 20 : 2.0-2.5 SPF / % TiO₂
2. PPS > 25 : 2.5-3.0 + SPF / % TiO₂

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